SRT Status and Plans for Version-7

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Accomplishments since May 2013 Meeting

Our major accomplishment has been to bring SRT Version-6 up to date with JPL

Some previously unknown differences were found and corrected

SRT Level-2 and Level-3 Version-6 and Version-6 AO results now match JPL

We have also made improvements to the water vapor profile *q(p)* retrieval step

Short Range SRT Plans for Version-7

Re-optimize details of all retrieval steps

Most optimization previously done used 2 regression start up state

q(p) retrieval had not been modified since Version-4

Version-6 *q(p)* retrieval degrades Neural-Net guess

We have already made significant improvements in *q(p)* retrieval methodology in our current SRT Version-6.1

q(p) retrieval now takes tropopause height into consideration

Ozone retrieval step should do the same

Version-6.1 *q(p)* retrieval performs much better than Version-6

We will further revisit *q(p)* channels, functions, and damping

We will consider a second pass *q(p)* retrieval step

Not found useful in Version-5 and never tested in Version-6

Version-6.1 Changes made to Water Retrieval Step

Modified Neural-Net $q^0(p)$ guess above the tropopause

- Linearly tapers the neural net guess to match climatology at four fine levels above the tropopause

Changed the 11 trapezoid *q(p)* perturbation functions used in Version-6 so as to match the 23 functions used in *T(p)* retrieval step

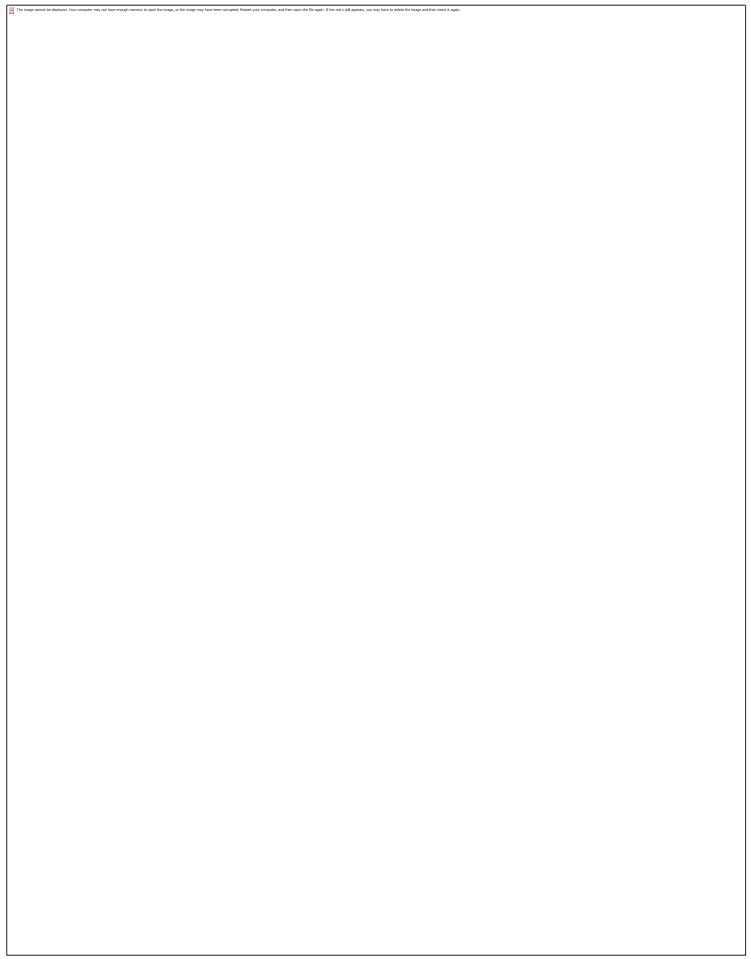
Increased the damping used in *q(p)* step because we now have more functions

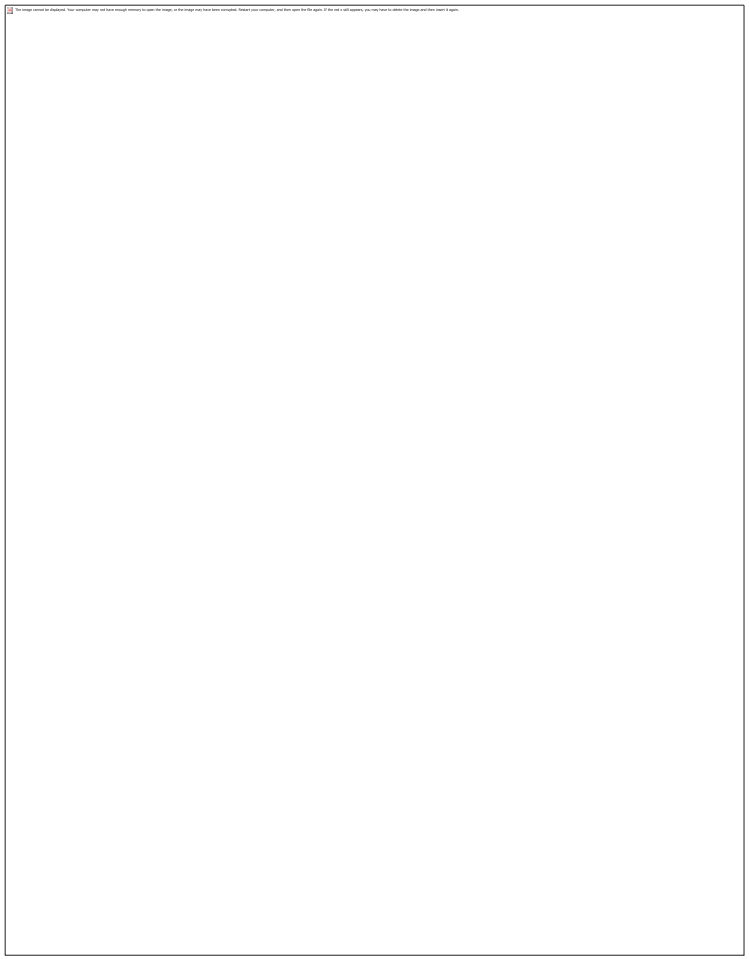
Results tested on May 30, 2010 data

Global Water Vapor May 30, 2010

Percent Yield

1 Km Layer
Precipitable Water RMS
% Differences from ECMWF



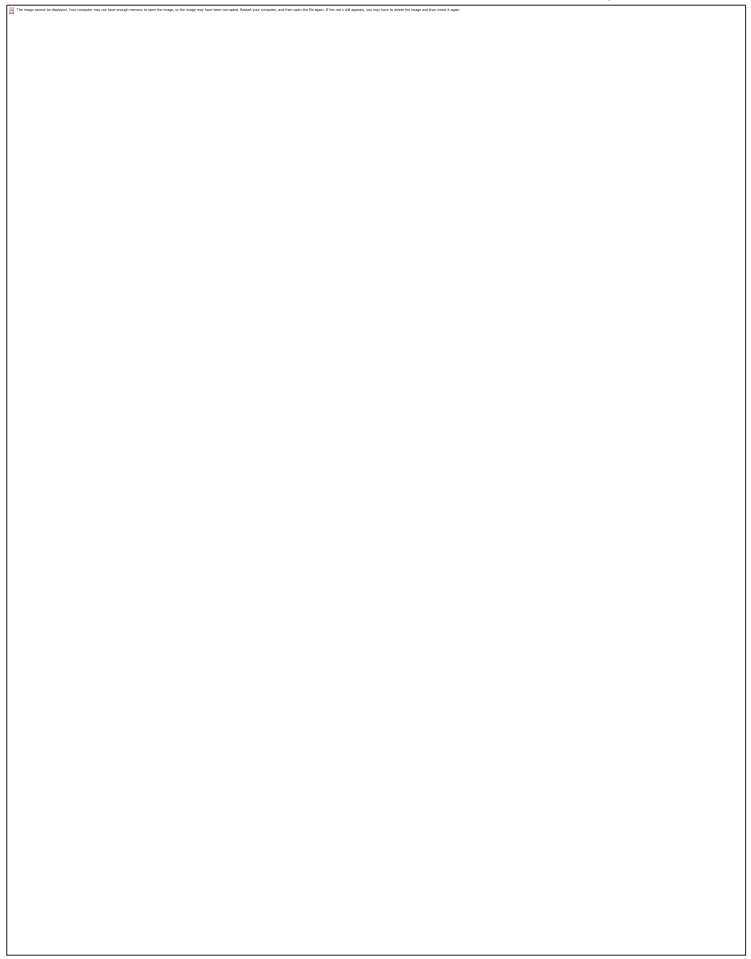


———	Version-6	DA (QC=0; PBest)
- - - -	Version-6	Climate (QC=0,1; PGood)
———	Version-6.1	DA (QC=0; PBest)
- - - -	Version-6.1	Climate (QC=0,1; PGood)

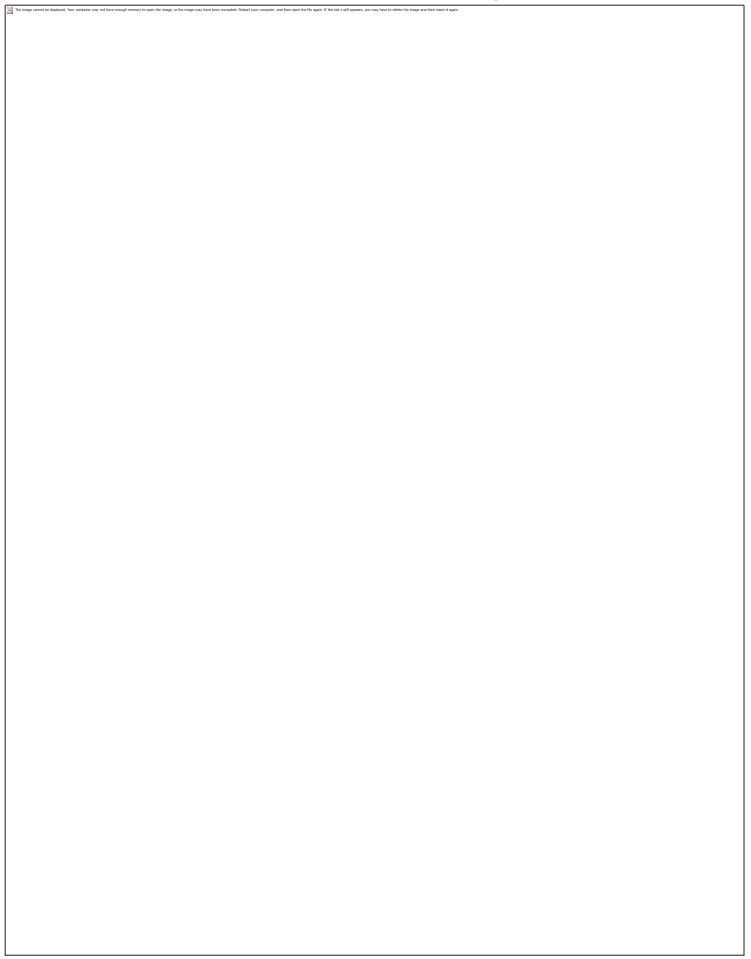
Accuracy with Climate QC has improved considerably over Version-6
Data Assimilation (DA) accuracy has also improved with increased yield

Global Water Vapor May 30, 2010

1 Km Layer Precipitable Water RMS
% Differences from ECMWF
Data Assimilation QC



1 Km Layer Precipitable Water RMS
% Differences from ECMWF
Climate QC

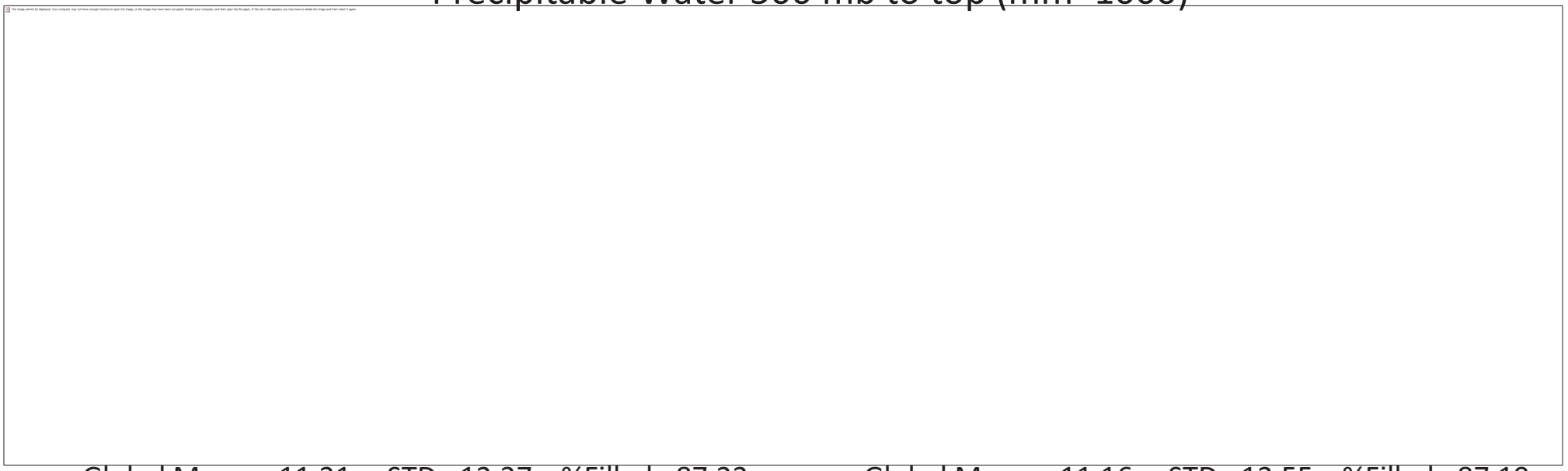


———	Version-6	DA (QC=0; PBest)	- - - -	Version-6	Climate (QC=0,1; PGood)
———	Version-6	Neural-Net (QC=0)	- - - -	Version-6	Neural-Net (QC=0,1)
———	Version-6.1	DA (QC=0; PBest)	- - - -	Version-6.1	Climate (QC=0,1; PGood)
———	Version-6.1	Neural-Net (QC=0)	- - - -	Version-6.1	Neural-Net (QC=0,1)

Version-6.1 retrieval no longer degrades Neural-Net guess beneath 800 mb and improves Neural-Net guess above 800 mb with Climate QC

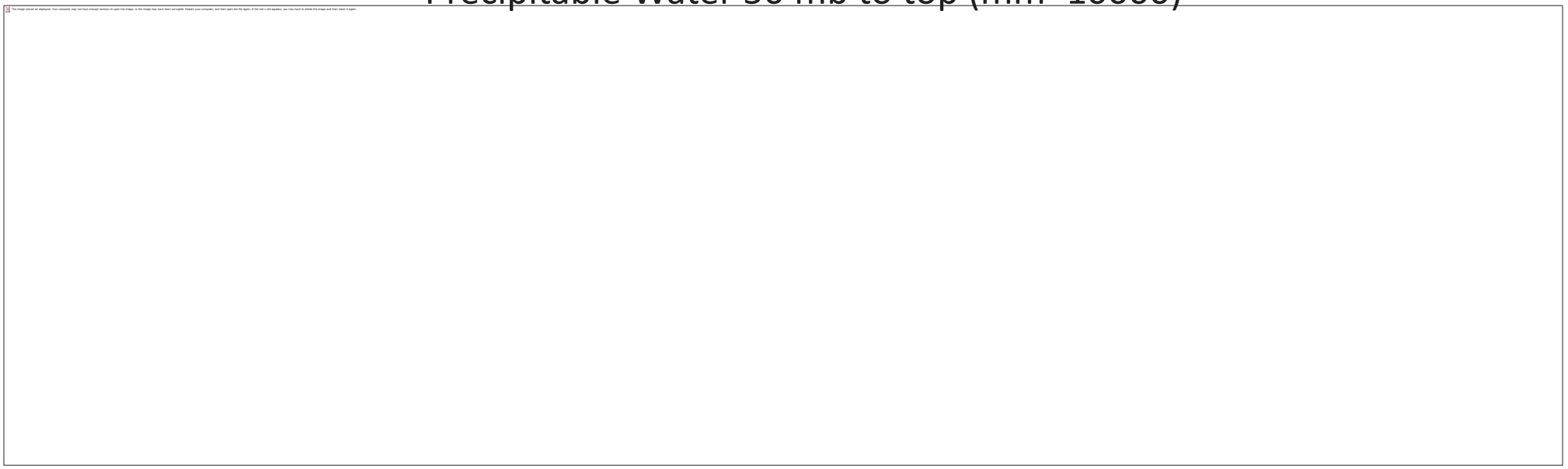
May 30, 2010 1:30 PM

Precipitable Water 500 mb to top (mm*1000)



Global Mean = 11.21 STD= 12.37 %Filled= 87.22 Global Mean = 11.16 STD= 12.55 %Filled= 87.19

Precipitable Water 50 mb to top (mm*10000)



Global Mean = 1.55 STD= 0.03 %Filled= 87.35 Global Mean = 1.21 STD= 0.27 %Filled= 87.35

Version-6 erroneously contained tropospheric convection features in upper stratospheric water vapor field. This has been corrected in Version-6.1.

More Short Range SRT Plans for Version-7

- Improve temperature profile retrieval by using tropospheric 15 *μm* CO_2 channels that do not see clouds.

  Theory says that 15 *μm* CO_2 channels that see clouds should not be used in *T(p)* retrieval. Version-6 assures this by using only stratospheric sounding CO_2 channels in *T(p)* retrieval

  Many tropospheric 15 *μm* do not see clouds depending on the scene and can (should) be used in *T(p)* retrieval for that case

- Evaluate the use of the difference in brightness temperature between 2 channels on and off weak CO_2 and H_2O lines as single pieces of information
- Improve $O_3(p)$ retrieval step
- Further refine error estimate and QC methodology
- Further stabilize cloud parameter retrievals

  Some retrievals still do not converge

SRT Mid-Range Plans for Version-7: Higher Resolution (HR) Retrievals

Implement 1 (cross track) x 3 (along track) FOV retrieval system

This triples the spatial resolution and density of the AIRS soundings

Cloud clearing allows for up to two cloud formations in a 1x3 FOR

	Nadir FOR	Largest Zenith Angle FOR
Version-6	40.6 km x 40.6 km	115.0 km x 63.3 km
HR	13.5 km x 40.6 km	38.3 km x 65.3 km

Cloud clearing should improve, especially over land, because spatial variability of T_{skin} , ε_{ν} , $q(p)$ is less in a smaller FOR

Retrievals should also improve, especially over land, because quantities to be retrieved vary less within a FOR

Boundary layer temperature and boundary layer water vapor should improve as well

SRT will investigate generation of 0.5 degree x 0.5 degree level-3 products using HR system

SRT Mid-Range SRT Plans for Version-7: Longwave Cloud Spectral Emissivity

Version-6 uses 57 channels to retrieve cloud parameters for each of two cloud layers *k=1,2* for each AIRS Field of View (FOV)

$$\alpha\varepsilon_1, pc_1, \alpha\varepsilon_2, pc_2$$

where $\alpha\varepsilon_k$ is the product of a spectrally independent cloud emissivity and the geometric fractional cloud cover for a cloud at pressure pc_k as seen from above

We plan to determine a cloud spectral emissivity ratio $\alpha\varepsilon_\nu/\alpha\varepsilon^0$ for the upper level cloud in a form analogous to longwave surface spectral emissivity retrieval which uses 77 channels

This can be done one of two ways:

- Sequentially after current cloud retrieval step, using the current 77 surface longwave emissivity channels or
- Concurrently with cloud retrieval using 57 channels + 77 channels (134) channels

Cloud spectral emissivity will be used in spectral OLR calculation

Longer Term Plans

1) Include CO_2 retrieval as part of retrieval process

   CO_2 retrieval is currently a post processing step

   Does not interact with anything else

   We plan to work with Ed Olsen to examine feasibility of:

   - doing CO_2 retrieval after pass 1 and using retrieved CO_2 in recomputation of *T(p)*, OLR, everything else
   - and possibly attempting coupled CO_2, *T(p)* retrieval

     Mous said this cannot be done – I am not so sure

2) Incorporating dust retrieval as part of retrieval process

   - Including dust score as part of error estimate procedure

     This could help flag poor dusty retrievals

   - Including dust into the RTA used in second pass

     This could potentially improve retrievals in dusty cases